APPLICATION FOR

UNITED STATES LETTERS PATENT

Be it known that we, Don R. Auten, a citizen of the United States, residing at 8101 Stewarts Ferry Parkway, Nashville, TN 37214; Richard T. Akers, a citizen of the United States, residing at 4841 Cimarron Way Drive, Antioch, TN 37013; and Richard Gembar, a citizen of the United States, residing at 1102 Woodridge Place, Mt. Juliet TN 37122; have invented a new and useful "System and Method for Generating and Controlling a Simulated Musical Concert Experience."

BACKGROUND OF THE INVENTION

The present invention relates generally to audio and video simulations of a pre-recorded musical performance.

More particularly, this invention pertains to the generation and control of a simulated musical concert experience and participation by a musician in a pre-recorded musical performance using a musical instrument as the control device.

Virtual reality systems are generally recognized to be a combination of computer hardware, software, and peripherals which recreate a virtual world or virtual environment using a video display, often in combination with an audio sound system. Conventional virtual reality systems are quite complex, combining the hardware, software, and peripheral devices in a specific manner

to immerse or subject the user of the system to visual and sound stimuli which simulate a real world experience. Typically, a virtual reality system further includes one or more input devices and interface software so that the user of the system can interact with the virtual environment that is being recreated, such as to simulate the user movement in the environment or manipulation of virtual objects reproduced in the virtual environment.

Virtual reality systems in the prior art have been used for entertainment purposes, to conduct scientific experiments, or to allow a user to indirectly carry out tasks which would otherwise be too difficult or dangerous when conducted in a real environment.

To a lesser extent, virtual reality systems have been used to create and control a virtual world that responds to music signals or to pre-recorded control tracks corresponding to music signals. Such a system is disclosed in U.S. Patent No. 5,513,129, which describes a virtual reality in which a music source is connected to an electronic interface and to a virtual reality processor. The system is further controlled by one or more input devices, such as a head tracker and manipulator glove. The pre-recorded music, along with an optional pre-recorded control track, controls and manipulates objects within the virtual environment such that the music effectively drives the display of an animated graphical scene. However, the system described in U.S. Patent No. 5,513,129 does not provide a simple and effective method for allowing a musician to participate in and control a "virtual environment" through the actual operation

of a musical instrument, such as an electric guitar. Such a system would provide a source of entertainment to professional and amateur musicians alike. It also would assist musical instrument manufacturers in promoting the sale of their instruments by allowing a prospective purchaser to recreate a musical concert, to simulate the musician's participation in the concert, and to control the sound portion of the concert through operation of the guitar or other instrument. Preferably, such a simulation system would minimize the use of complex and expensive hardware and software so that the system would be easy to set up and affordable even at the retail store level. Such a system is lacking in the prior art.

SUMMARY OF THE INVENTION

In the simulation and control system of the present invention, the video and sound portions of a musical performance or concert is pre-recorded on a video tape, digital disc, or other media containing audio and video tracks. The sound portion of the concert will include a separate instrument track representing musical sounds that would be made during the pre-recorded concert by a specific musical instrument. The tape or disc containing the pre-recorded video and sound tracks is loaded into a conventional video disc or video tape player. The video output from the video player is connected to a video display, such as a stereoscopic headset. The audio output of the video player is connected to left and right audio inputs on a multi-channel audio

mixer. Means are provided in the mixer or in a decoder to separate the pre-recorded instrument sound track from the left and right concert sound tracks containing music from the other concert instruments as well as ambient crowd and backstage noise. The separated instrument sound track is then available for control by other system hardware.

A musical instrument corresponding to the specific musical instrument represented by the pre-recorded instrument sound track has its audio output connected to an instrument input on a system interface box. The interface box also includes an instrument track audio input connected to an output on the mixer, with a controlled instrument track audio output from the interface box connected to a separate audio input on the mixer.

The interface box includes an instrument track control circuit which electronically varies an electrical characteristic or parameter of the instrument track audio, such as the audio level. The instrument track control circuit in the interface box is responsive to the instrument audio signals received at the instrument audio input on the interface box. Accordingly, the playing of the musical instrument by the musician will control or vary the sound level of the instrument track provided to the mixer. The mixer combines the controlled instrument soundtrack with the left and right concert sound tracks, and provides the mixed audio to a mixer output connected to the speakers on the headset. The musician can then cause the system to vary the volume level of the instrument track in response to playing of the musical instrument.

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In a further embodiment of the system, the interface box includes a bypass circuit controlled by an external switch. For a normal system mode, only the controlled instrument sound track is provided to the mixer and therefore to the headset. In a bypass mode, as selected by the switch, the bypass circuit causes the interface box to suppress the instrument sound track and to provide the audio signals produced by the instrument directly to the mixer. In this bypass mode, then, the musician can hear himself play the instrument in synchronization with the concert video track and the left and right concert sound tracks, thereby enhancing the level of simulated participation. Preferably, the video portion of the pre-recorded concert is filmed as if "through the eyes" of an onstage musician so that the user of the system can assume that role while playing the instrument.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of the simulation control system of the present invention.

Fig. 2 is a schematic diagram of the system interface box used in the system of Fig. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The concert simulation and control system 10 is shown generally in Fig. 1. A musical instrument, such as a guitar 20, having one or more pick-ups or

other transducers that will generate electrical audio signals, when the guitar is played, at an instrument audio output 21. Instrument audio output 21 is electrically connected to an instrument input 22 on a system interface box 18. Interface box 18 includes an instrument audio output 23 which, as will be described below, can be switched to provide a direct electrical connection to instrument input 22.

In one embodiment of system 10, where the musical instrument is guitar 20, a musical effects processor 17 is electrically connected between instrument audio output 23 on interface box 18 and a corresponding mixer instrument input 26 on a multi-channel audio mixer 16. Effects processor 17 is of conventional design and will typically include electronically induced distortion, delay, and other special effects which electrically modify the audio signals generated by guitar 20.

The audio mixer 16 is also of conventional design and in one embodiment, will have eight audio channels. A pair of left and right source audio inputs 31 on mixer 16 are electrically connected to corresponding left and right source audio outputs 15 on an audio video ("AV") playback device 14. AV playback device 14 is also of conventional design, and can be a video tape player or DVD player. Accordingly, AV player 14 will also have a source video output 13 electrically connected to a video input 32 on a video display device, such as the video stereoscopic headset 11. Preferably, headset 11 will be a conventional head mounted display wearable by the player of guitar 20.

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Headset 11 will include left and right speakers driven by a pair of left and right headset audio inputs 33 which are electrically connected to corresponding left and right mixer audio outputs 12 on mixer 16. Three-dimensional viewing of the concert video is enabled by conventional 3D shutter glasses (not shown) inside the headset. A commercially available headset usable in this application is the Model CE200-W Cyber Eye headset from General Reality Company, San Jose, California.

The audio portion of the pre-recorded musical concert to be played back by AV player 14 will include left and right concert sound tracks and a separable instrument sound track, all of which are electrically transmitted to mixer 16. Mixer 16 can include conventional circuits capable of electronically separating the instrument sound track from the left and right concert sound tracks. Otherwise, the tracks are separated externally by AV player 14 or by an external decoder and provided to mixer 16 through discrete inputs. Accordingly, mixer 16 will further include an instrument track mixer output 27 electrically connected to an instrument track interface input 25 on interface box 18. In accordance with the novel control system and method of this invention, and as will be described further below, interface box 18 will preferably include a controlled instrument track audio output 28 electrically connected to input 29 on mixer 16. Mixer 16 can then, in conventional fashion well known to those of skill in the art, combine and mix the left and right concert sound tracks provided at input 31 by AV player 14 with the controlled

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instrument sound track provided at input 29, and output the mixed audio signal to the headset 11 at mixer audio output 12.

Interface box 18 can also include a switch input 30 electrically connected to an external switch 19 operable by the musician playing guitar 20. In conjunction with the bypass and control circuits of system interface box 18 as illustrated in Fig. 2 and described below, switch 19 will place interface box 18 in either a normal or bypass mode, allowing the musician to select from at least two different simulation modes available on system 10.

One embodiment of the system interface box 18 is shown schematically in Fig. 2. The instrument input 22 is electrically connected to a relay RL1. Relay RL1 has a "normal" position in which it will cause the instrument audio output 21 to be electrically connected to the inverting input (pin 2) of operation amplifier IC1, through resistor R1. Relay RL1 can be switched to a "bypass" mode whereby the instrument audio output 21 is electrically connected directly to instrument audio output 23 on interface box 18. Relay RL1 is caused to switch from the normal mode to the bypass mode by activation of switch 19 connected to interface box 18 at switch input 30. Preferably, switch 19 is a foot operated switch so that the musician can change the system mode while simultaneously playing guitar 20 with both hands.

When the system 10 and bypass circuit 18 are in the normal mode, the instrument audio signals are amplified by IC1 in a conventional manner, with the gain set by resistors R3 and R1. The audio signals at the output of

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amplifier IC1 are rectified by diodes D1 and D2. The ripple in the output signal from amplifier IC1 is reduced by capacitor C1, so that the output is a substantially DC voltage having a magnitude that corresponds to variations in the average peak magnitude of the audio signals from guitar 20. The rectified signal is applied to one input of an analog comparator IC2. The output of comparator IC2 is either "high" or "low" depending upon the relationship between the voltage at terminal 3 of IC2 and the voltage at terminal 2. The voltage at terminal 2 of IC2 is a comparator threshold set in conventional manner by potentiometer VR1 connected to a nominal five volt supply voltage. The output of comparator IC2 controls an electronic switch IC3, which can be a conventional CMOS switch, such as a type CD4066 available from National Semiconductor.

Electronic switch IC3 performs the function of switching instrument track input 25 on interface box 18 into the control circuit of interface box 18 such that the instrument sound track audio is electrically connected to controlled instrument track output 28 through a control device LDR1. Control device LDR1 can be any conventional signal conditioning device, such as an amplifier or an active or passive attenuator. In the embodiment of Fig. 2, control device LDR1 is a light dependent resistor, such as the type CLM5500 available from Javenco Electronics Supply. Accordingly, the instrument sound track audio signals are attenuated by a resistive portion of control device LDR1, which is varied by the output from a light emitting portion. Thus,

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control device LDR1 includes a light emitting diode having a control input driven by the output of amplifier IC1. Again, the output of amplifier IC1 is rectified by diodes D4 and D5, with the rectified signal further smoothed by capacitor C2, such that the variable DC voltage is applied across potentiometer VR2. Accordingly, as the RMS or average signal level or magnitude of the instrument audio signal increases, the voltage across potentiometer VR2 will proportionally increase, thereby increasing the current through the LED portion of control device LDR1. This decreases the attenuation provided by control device LDR1 of the instrument sound track audio between instrument sound track audio input 25 and controlled instrument sound track audio output 28. Using such a control circuit, then, and when the system 10 is in the normal mode, the musician will hear the pre-recorded instrument sound track on the headset at a volume that varies in proportion to how hard or how soft the musician is striking the strings of guitar 20. This control effect provides a simulation of the musician actually participating as a player of the instrument in the pre-recorded musical concert.

In a further embodiment of system 10, an additional switch output can be provided on switch IC3 and connected to a control input on AV player 14, such that generation of instrument audio signals by playing of the guitar 20 will activate playback of the pre-recorded musical concert from AV player 14.

In yet another embodiment of the system 10 in which AV player 14 is a DVD player, having a conventional PCM/AC-3 digital audio output at source

audio output 15, a Dolby Digital Decoder can be placed in the audio circuit between source audio output 15 and mixer source audio input 31, to digitally separate the pre-recorded instrument sound track from the pre-recorded left and right concert sound tracks.

Although system 10 is shown and described for use with an electric or amplified acoustic guitar, it can be used with a variety of other musical instruments which either directly, or indirectly through an interface device, will produce electrical audio signals representative of the sounds made by the instrument.

Also, in the embodiment of system 10 as described and shown, the characteristic of the pre-recorded instrument sound track that is controlled by the control circuit in interface box 18 is the signal level or magnitude of the audio. However, by changing the nature of the control circuit, different parameters of the instrument sound track audio can be varied in response to operation of the musical instrument. For example, a controllable analog or digital audio filter could be substituted for the light dependent resistor shown in Fig. 2, whereby the frequency response of the filter will vary in accordance with the voltage across potentiometer VR2, thereby changing the frequency or tonal characteristics of the instrument audio track as the guitar 20 is played.

In many applications, a wearable stereoscopic headset with left and right speakers is an ideal combination of a video display and audio transducer to be used with system 10. However, in other applications, a two dimensional

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video display can be used, either wearable or not, in conjunction with floor or wall mounted audio speakers. Or, multiple audio and video playback and display systems can be used in parallel.

Generally, the pre-recorded musical concert will be recorded on video using a stereoscopic camera to produce a "3D" playback effect, with simultaneous audio recording of the concert sound tracks and, usually, the instrument sound track. Other backstage footage can be included to simulate the musician's participation in pre-concert preparation and build-up. To further create the virtual concert experience, additional backstage and onstage audio can be recorded, either during filming of the actual musical performance or later in the studio. The separate instrument sound track can be recorded live in conjunction with the video and other audio portions of the musical concert or can be added later or re-mixed in the studio. If the system 10 is to be used by an instrument manufacturer to promote the sale of its products, suitable marketing and promotional logos and messages can be superimposed over the concert video and/or audio while the system is in operation. To this end, the pre-recorded video can include a segment where the musician is shown selecting a specific manufacturer's instrument to play on stage.

One advantage of this system is that no computer is needed to operate or control it. If a DVD player is used for AV player 14, multiple pre-recorded concert segments can be placed on the disc, allowing the user of the system to

easily switch to other programs (a jazz club, a country music festival, etc.), representing a favorite experience, venue or band.

Thus, although there have been described particular embodiments of the present invention of a new System and Method for Generating and Controlling a Simulated Musical Concert Experience, it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the following claims.